BULLETIN

of the

American Association of Jesuit Scientists

Eastern Section
Founded 1922

Published at
CHEVERUS HIGH SCHOOL
Portland, Maine

VOL. XXIV **MAY, 1947** **NO. 4**

Contents

Bulletin of American Association of Jesuit Scientists

EASTERN STATES DIVISION

VOL. XXIV MAY, 1947 NO. 4

A Chemist's Prayer

By Therese Southgate

A Student in the College of Saint Francis, Joliet, Illinois

I am like a chemical compound in Your Laboratory of Life, O Lord, a compound from which the element Perfection has not yet been isolated, a compound in which the properties of the element Perfection are disguised by combination with earthly vanities. Take me then, O Lord, analyze me according to my good and evil constituents and isolate the pure element Perfection, as a chemist analyzes and separates from a substance all foreign matter. Analyze me that I may learn to know myself and that I may emerge a pure element, worthy to be included in the group of elements already freed from the bonds of earthly life.

First, grind me in the mortar of childish whims, that I may emerge a composite sample of Your Likeness. Weigh me on the balance of Your generosity and decide how great a sample I shall be in Your Laboratory of Life. Then ignite me in the furnace of Your Love, that the carbon dioxide of earthly vanities be driven off. Cool me with the balm of Your mercy. Dissolve me in Your grace and filter me through the fine mesh of earthly trials so that imperfections may be banished. Precipitate my evil tendencies with the strong precipitant of Your Justice and isolate them from Your compound. Precipitate the gelatinous silicate of earthly attachments which draw me from You. Imprison me in Your Love with the mordant of sacrifice. Digest me in the length of my life, that my good deeds will grow and that self-satisfaction shall not be occluded with them. Blast out any impurities that may be introduced and finally, seal me forever, a pure substance in the container of your Eternal Happiness.

J. Chem. Ed. 23 10, *Oct.* 1946. *Page* 507

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Obituaries

REVEREND HENRY J. WESSLING, S.J.
1881-1946
R.I.P.

Reverend Henry J. Wessling, S.J., well known as the blind priest, was born in Boston on April 5th, 1881 and died there on the Feast of the Epiphany 1946, after a life in the Society which, in some respects, was unique, but full of merit and achievement. While most of his years were devoted to the work of the ministry and to various offices in his community, it seems fitting that he should find a place in the Bulletin, not only on account of his long continued interest in science and his work as a scholastic in the lecture room and laboratory, but also because he was a member of our Association and a contributor to the Bulletin.

He received his early education at our High School and College in Boston, which then formed one institution. After his sophomore year, he entered the Novitiate at Frederick, Md. with several College companions on August 14th, 1899. He was of a serious nature and seemed at home from the beginning. The novices numbered about fifty at that time, the Rector and Master being Fr. John H. O'Rourke. During his rhetoric year, on January 15th, 1903, the community had the unusual experience of migrating to its new home at Poughkeepsie. The abrupt change from the old Novitiate in the heart of the city, with its small "Garden" enclosed by a high stone wall, to the new spacious Building at St. Andrew with its extensive grounds affording glorious views up and down the lordly Hudson always remained vivid in his memory. There was much pioneering to be done in the new home and he did some surveying, helping to lay out the first tennis court and part of the ground in front of the house. While still a novice, he had found an outlet for his zeal teaching catechism, first in St. John's Church opposite the Novitiate and later at a little mission at Point of Rocks, a railroad junction on the Potomac near Brunswick, Md. So also a few weeks after arriving at St. Andrew we find him walking to Poughkeepsie on Sunday afternoons to teach catechism in the German Church there. The following summer he was one of the first group of "graduates" to leave for Woodstock. Here he could indulge his taste for science giving extra time to chemistry and mathematics. After teaching these subjects at Holy Cross College for two years, he and a fellow scholastic in 1908 were the first to go from the East to teach science

at Canisius College in Buffalo, which had shortly before been incorporated into the Maryland-New York Province.

Mr. Wessling's scientific interests had broadened and he had gathered valuable experience in lecture room and laboratory, when the tragic accident occurred which put an end to his teaching career and changed the course of his life. On Saturday afternoon in October 1910, he prepared a solution for silvering a mirror. The following Monday morning after breakfast he went to the laboratory either to use it or perhaps merely to inspect it. Upon taking up the beaker there was a sudden violent explosion. The Brashear process which he was following is described in the more advanced Laboratory Manuals although all do not point the dangers it involves. Strong's "Procedures in Experimental Physics" p. 154 gives each step in detail. The danger of explosion at one stage is noted and caution is recommended. Mr. Wessling must have known the nature of the reactions and the necessary precautions, but perhaps he did not fully realize the greater danger of allowing the solution to stand for any length of time. Strong says, "The formation of the explosive, fulminate of silver, is not particularly favored by the low concentration of solutions and moderate temperatures that obtain here, but these relatively weak solutions will give fulminate on warm days if they are allowed to stand. This compound explodes on the slightest provocation when dry and sometimes when wet. "

He was alone when the accident occurred and he instinctively rushed to the sink to wash out his eyes. Unfortunately there was little or no water. He tried another sink. He then hurried through an unused dormitory and was met by a fellow scholastic, now Fr. Henry Kelly, who brought him to a bath room on a lower floor where there was ample water. It was too late, however, as the damage had already been done. Many must have wondered how—of all places—there could have been a dearth of water in a chemical laboratory. Fr. Michael J. Ahern, who took Mr. Wessling's place as professor of chemistry the following year, has informed me that the laboratory was on the top floor of the old College which then adjoined St. Michael's Church. The city water pressure was not sufficient to provide for the needs of this floor. For this reason there was an auxiliary tank on the roof and it was the engineer's task to fill it regularly. Fr. Kelly in a letter also mentioned this tank and states that he is under the impression that it was being cleaned at the time. Whether this was the case or the engineer had not yet started his pump on account of the early hour, the fact remains that when the need was greatest the tank was empty. Mr. Wessling received the best medical attention in Buffalo and later in New York. Although the interior of his eyes had not been affected and he could distinguish light from darkness, the damage done to the anterior surfaces could not be repaired.

In the fall of 1911 Mr. Wessling returned to Woodstock for

theology, although at the time there was no indication that he would ever be ordained. He attended lectures regularly and repeated the matter with a few devoted friends. His classmates were ordained and he finished the course with them and still there was the uncertainty. At last after long and patient waiting the unusual dispensation came from the Holy See. He was ordained Sub-Deacon and Deacon by Bishop Collins of Jamaica on December 19th, 1917 and received the Order of Priesthood from Cardinal O'Connell in the Church of the Immaculate Conception in Boston. After his tertianship at St. Andrew he was assigned to the Boston College High School where he spent the remainder of his life.

His great ministry was that of the confessional and for nearly thirty years he accomplished immense good, giving comfort and guidance to numerous souls. At various times he filled the offices of Spiritual Counsellor of the boys, Spiritual Father of the Cummunity, Prefect of Reading and House Librarian. When he took charge of the Library he found many depleted shelves as a goodly number of books had gone to Chestnut Hill when the College Faculty took up its residence in St. Mary's Hall. With the aid of a secretary who also read to him, he rearranged the library, added new shelves and, in the course of years, made extensive additions on all subjects including science. Books were kept in perfect order and promptly catalogued. He knew the exact location of not a few books and it was not unusual for him to take a visitor to some particular shelf and take down some work for inspection or perusal.

One can surmise that for one of his temperament the early days of Father Wessling's blindness must have been a time of trial and keen suffering. But his faith and courage, aided by grace, triumphed and all who knew him marvelled at his heroic acceptance of the loss of his sight with all that went with it and his constant cheerfulness. In this respect he was an inspiration to all and in particular to his religious brethren. He did not ask with the blind poet, "Doth God exact day-labor light denied?" He strove to lead the normal life of a Jesuit, depending as little as possible upon others for help. There was no embarrassment in meeting him as he expected no expression of sympathy or special consideration. Freed from many of the distractions which beset others, his mind was clear and active and his memory keen. He would discuss current events or engage in some friendly argument in which he usually felt quite sure of his ground. Upon entering his room even after a long absence it was impossible to deceive him by attempting to disguise one's voice. His old friend Father Joseph S. Didusch relates how he visited him once after not having seen him for several years. He shook hands without saying a word and was immediately recognized.

Father Wessling's knowledge of theology was remarkable for one who had never looked into a book on the subject during his course. This

appeared in his discussions and it was also remarked on the occasion of a Triduum he gave at Weston. He always kept up his interest in science, following as far as possible new developments. He became a member of our Association at the Second Annual Meeting held at Fordham in 1923. On that occasion he presented a paper read by Fr. Edward C. Phillips on the Cyclotomic Hyperbola. An abstract appeared in the Proceedings in which mention is made also of a mechanical device constructed by the author for trisecting an angle. He also published a longer paper on the same curve with diagrams in the Bulletin for July, 1944 (Vol. XXI, No. 4.) Lux perpetua luceat ei!

REV. HENRY M. BROCK, S.J.
Weston College
Weston, Mass.

REVEREND CLARENCE EUGENE SHAFFREY, S.J.
1880-1947
R. I. P.

The Rev. Clarence Eugene Shaffrey, S.J., head of the Department of Biology at St. Joseph's College was fatally injured on Friday, February 14, 1947. As he was crossing City Line from the college to the faculty residence, he was struck by an automobile and died within 20 minutes. Extreme Unction was administered by the Very Rev. John J. Long, S.J., president of the college.

Father Shaffrey was born in Logansport, Ind., on April 30, 1880 He entered the Society of Jesus in 1905, after receiving an M.D. degree from Rush Medical College and completing his interneship in the Alexian Brothers Hospital, Elizabeth, N. J. Upon completion of his studies at St. Andrew-on-Hudson and Woodstock College, he joined the faculty of Fordham University in the Department of Chemistry and after one year, transferred to Fordham Medical School.

Father Shaffrey was ordained at Woodstock in 1918, served as emergency chaplain at Camp Meade during the flu epidemic, and then went to Boston College to teach biology and organic chemistry. In the fall of 1925, he came to St. Joseph's as head of the Department of Biology and for 22 years, he taught the course that has become famous in educational circles for its excellence of preparation for the medical profession. The success of Father Shaffrey's efforts in behalf of the students of St. Joseph's College over these years is recorded in the long roll of distinguished physicians and surgeons who began their study of medicine under him and who loyally and enduringly sustained the bonds of friendship with him.

In the classroom Father Shaffrey was an exacting disciplinarian, but no one can deny that "his boys" were ever close to his heart. He was a scholar and a man of science. Recognizing the necessity for preciseness, he regarded it his duty as a teacher to instill in his students the spirit of science. He demanded work and got it, but whatever he asked of his pupils he first asked of himself. He was exacting because exactitude is a requisite in science.

Few were aware of his charitable works although they were many. Whether among his own Jesuits or among the needy in the secular world, he was always willing to go out of his way to distribute the benefits of his kindness. He was a priest of God and he performed his priestly duties with Christ-like charity. No task was too big or too small to receive his generous attention.

We can pay no worthier tribute than that which was contained in the citation awarding Father Shaffrey the honorary degree of Doctor of Laws in June 1946 at St. Joseph's College:

"Mankind has often attested the honor in which it holds those professions whose members, divesting themselves of the will to self-aggrandizement, unselfishly promote the general welfare.

"Such is the profession of the Doctor of Medicine . . . Such is the profession of the teacher . . . Such is the profession of the Priest . . .

"Thrice selfless, then, unique, and singularly worthy of tribute is the long and strenuous career of this man who has harmonized, over a lifetime, the functions of all three of these great professions. For he has formed men who will practice medicine for their fellow-men and for Christ, Our Saviour."

Biology

THE LIFE OF SPIDERS[1]

Walter Janer, S.J.

Spiders swim and dive, they dance and court, they have amazing instinctive powers, they hunt and trap their prey, and what is more interesting to an aeronautically inclined age, they even fly! To the casual observer these mysteries are hidden because spiders are nothing but bugs to them and further they are universally feared and believed to be very dangerous due to the venom of their bite. Yet the Author of Nature who gives with such profusion has given them a definite role to play too, and the new world they open up affords new knowledge and interesting and pleasant hours of study and observation to anyone who is patient and curious enough to want to learn something about the other creatures of this wonderful world we live in.

Spiders are to be found everywhere from the tropics to the snow lands of the North. They like to build their homes in dark corners of houses or across swift running brooks, under stones in fields or in bushes and thickets. Some of them burrow into the ground and build traps of amazing ingenuity. Have you ever wondered why dust gathers in corners . . . look around and you will find a small web of the house spider, which catches the particles and unwittingly accuses the careless sweeper. How many times in walking through the woods does not one have to sweep the sticky web from face and clothing, although it was at first sight invisible!

Some of them are large enough to be called bird spiders and have been known to catch small birds. Occasionally there are pictures in a book of a snake caught in the strands of Nephila or Aurantia. Yet some of them are very, very small and try hard the classifier and collector. In general their appearance is known to everyone, for their abdomen with its sac-like shape is very conspicuous and often brilliantly colored and beautifully designed. Around Spring Hill* the largest spider we have found is Nephila clavipes, a large yellow-orange spider which spins a bright orange web near some brook or damp place. The strands shine brightly in the sun and the silk is very strong. This particular spider was once thought to be useful for commercial purposes and was so used by the Chinese and later the French. The

[1] This study was conducted by the author while he was a Philosopher at Spring Hill College, Mobile, Alabama.

adventure was later abandoned as impractical, but there is mention of a pair of gloves made from the beautiful orange silk, which was sent to a French empress. This spider is as large as two inches and a half long excluding the length of the legs, and thus quite easy to see. On the other hand we have at Spring Hill the small Lyssomanes viridis, a tiny almost transparent green creature with bulging black eyes and very aggressive. This small one, likes to be near water, usually around some pump handle or faucet. He is not afraid to fight for his home, but is too small to scare most people . . . they do not even notice him, yet he is very beautiful both in color and shape. There are many smaller species than Lyssomanes, especially under the pine needles where the Drassids like to hide and hunt. They resemble ants, but their coloring betrays them quickly. We have then all sizes at Spring Hill from Nehila down.

Spiders catch their prey usually in their webs. One of the types of silk they spin is sticky and remains that way. When the unwary insect strikes the web, he sticks, the spider rushes out from under a leaf or twig and throws more liquid silk on the prey and attempts to bind him more firmly. If the bug is not too large the spider will proceed to bite it and inject enough poison to kill it at once or quiet it while it calmly proceeds to wrap it up securely in silk in order to secure the meal-to-be. If the victim is large and makes a great rumpus, the spider merely lets it wear itself out and then approaches with the killing bite. Spiders suck the blood and body juices from their prey by means of a sucking-stomach which has powerful muscles aptly suited for a strong sucking motion. They reject victims which are not active, and but rarely will eat a dead insect. This I have seen happen once, in the case of a Black Widow which had been starved.

Mating is very interesting among the spiders. The male is usually very much smaller and completely out of proportion as compared to the female. He has neither the same brightness of color nor does he even spin a similar web in most cases. Up to a certain number of molts the sexes are undistinguishable, but then the male palpi bulge at the tips and give the appearance of little boxing gloves. From then on the females continue to grow but the male remains small and as soon as maturity is reached sets out as a wandering minstrel to find a suitable mate. It has always been a matter of wonder how seldom the male is found, and whenever he is seen it usually is in the web of the female.

A most remarkable fact is that every single species of male has palpi which are different in some way from every other species and which correspond only to the genital apparatus of the female of that species. So much so is this that cross fertilization is almost impossible due merely to the external form of the genital apparatus which is different in some way in every species. The male spider deposits the

sperm in a cocoon of silk which he builds for the occasion. He then collects it with the specialized structure of the palpi of the male. The seminal fluid is then transferred to the female genital pore. Frequently the female will dine on her husband, especially if he stays about too long after fertilization. This habit of eating the male has earned for Latrodectus mactans the common name of the Black Widow.

The female is very prolific and will lay in most cases hundreds or thousands of eggs. Late Summer or Autumn is the time for depositing the eggs. At this time the female will spin a cocoon of a special type of silk, in which she deposits the eggs. The outside layer of the cocoon or egg sac becomes hardened with the air and usually looks dirty yellow or brown. The inside remains soft and flossy and is a perfect cover and shock absorber for the delicate eggs. Many of these egg sacs are laid by each female and into them she keeps storing her eggs as often as they mature. Only one fertilization is necessary for the many eggs she will lay over a long period of time.

The type of egg sac varies with the different species. Some are carefully deposited in between leaves for better protection and then these are fastened together to hide them. Other egg sacs are attached to the side of the bark of trees and look like the cocoon of an insect. Still others may just hang at the end of branches attached by a strong silken strand and looking much like a dried berry. The most curious of all are the ground spiders like the Lycosae which drag the egg sac around attached to the posterior end of the abdomen, or in some cases held by the chelicerae. When these latter hatch the young spiderlets climb on to the mother and let her carry them about. It is almost certain they do not feed on her. The maternal instinct is remarkable in this last named group. If you take the egg sac away from the mother she will seek it, and if you make a little ball of the same dimensions and offer it she will proceed to attach that to her abdomen and carry it with nonchalance. They will also defend the eggs with much aggressiveness.

Usually the eggs finish hatching in the Spring. When the spiderlets are ready to come forth, they bore a tiny hole in the side of the sac and on coming out spin a web of fine silk about the sac. Here they remain in a period of rest for several days. They do not feed at this time. Of course they are very small and do not resemble in color or markings the adult although in shape they are already very much alike, and if any change takes place it is not great. (This regarding external form). After this short period of inactivity the young spiders begin to show their cannibalistic instincts and if the group does not disperse they will feed on one another. This already begins to account for the reduction of their numbers.

At this time the spiders actually fly. The spiderlet seeks the end of a branch or goes up a bush seeking some altitude. It deposits a

silken attachment to the spot and lets out long silken strands into the air. When a gust of wind comes it lifts up the abdomen and the air carries him forth into the world beyond. The threads are the gossamers so often seen in Spring and early Summer.

The enemies are now increased. Besides eluding his hungry brothers and sisters the spiderling must take care against other spiders, wasps and birds. Weather may kill him and being so small, food is not easy to catch in the tiny web. So although the hatched number is great, not many reach the adult stage.

Finally the spider will find an appropriate spot where it may spin its web. Here again generic and even specific characters are demonstrated. The strong, bright orange but seemingly carelessly constructed web of Nephila differs from the accurate and beautiful triangular web of the Triangle spider. *Hyptiotes cavatus. Aurantia miranda,* one of the garden spiders, reinforces her home with a peculiar strip of silk, the stabilimentum which runs up and down zigzag from the center of the web out. There is the work of art of the tiny spiny-bellied spider, *Gasteracantha cancriformis*, a lace design so simple yet so beautiful it compels admiration. Of course, not all spiders spin elaborate webs since the web is primarily intended as a trap for food. Those suited to the ground environment, like the Lycosa or wolf-spiders and the Attidae or jumping spiders pursue their prey much like a hunter.

Once established in its home the spider grows. This is done by moulting. As soon as the spider becomes too big for its skin it sheds it and grows a new one! Before the period of moulting the spider retires to a retired part of the web where there is more protection. Once the skin is shed it remains in a period of quiet for several hours while the skin hardens. It is quite helpless at this time, nor is moulting easy. It is carried on with great difficulty and frequently the spider dies in the attempt to shed its old skin. The number of moults vary with the species. In the Black Widow the male moults less than the female hence attains maturity sooner. As the moultings proceed, the immature colorings begin to disappear and the characteristic adult colors and designs show themselves gradually, until at the very last shedding the spider emerges as a full grown adult.

The specialized silk organs in the spider are at the posterior abdominal end and they are independent of the alimentary canal or any other organ or system of the body. Spiders depend more on their silk than on anything else for practically everything that concerns their life cycle, and it is interesting to know they do not use the same type of silk on every occasion.

This terminal portion where the spinning apparatus is found is called the *spinning field*. Here are the spinnerets, the spinning tubules and the silk glands. Spinnerets are usually six in number arranged in

rows of two, fore, middle and hind. They are highly mobile appendages and have at least two joints although three, even four may occur. The middle spinnerets are not segmented but the hind and fore always are. The whole field is covered with hairs which are tactile and serve for protection. Whether they serve some purpose in spinning is not determined. Inside the spinnerets are the numerous spinning tubules which are the outlets of the silk glands. The tubules are as many as a hundred to a spinneret and in some families there is an additional structure the *cribellum* which contains thousands of tubules. Each tubule again contains innumerable glands so the total number is simply enormous. The tubules are of various shapes and sizes each throwing forth a characteristic type of silk.

Some enumerate as many as seven kinds of silk glands differing in color, form, number, structure of their ducts and the nature of their product. Not all seven are found in one spider but five types have been identified in *Angelina naevia*—the grass spider.

As the spider walks about it stops every so often and makes what is called an attachment disk. This is the base to which it will attach a thread of silk as it continues on. Then in case it loses step the spider does not fall but rather pulls itself to the attachment disk and is safe. The thread is known as a drag line, and the movement of making attachment and letting out the drag line is so rapid that the unobservant never notice it. There is another type of silk used by the spider to entangle her prey or enemies. Usually liquid silk is skillfully thrown on the victim which acts like glue, then a strong swathing band of still another type is spun about the prey. The web is built of different kinds of silk, and the egg sac which must protect the eggs for a long time also has its special brand. The answer then to the sea of gossamer in the morning sunlight, the hundreds of webs, the invisible threads of the woods which stick to everyone, and the indescribable tapestries which are the spiders' homes have their answer in the little factory with which the generous Author of Nature has endowed these least of His creatures.

All spiders have poison glands which are used to kill their prey or enemies. Spiders are, except for one exception in the U.S.A., absolutely harmless to man. Some superstition from the Middle Ages concerning Tarantism, a disease said to be caused by the bite of the Tarantula, still remains about. In the first place Tarantulas are not real spiders, secondly the "spider" referred to was not a Tarantula, and finally our common Western Tarantula although it causes a painful bite, is not harmful to man. It merits our friendship for it feeds on grasshoppers and roaches. *Sericopelma communis*, a large Central American Tarantula catches and kills birds. Its bite is said to be extremely painful but not deadly to man. The giant in the spider world is the *Theraposa leblondi*, a South American Tarantula with a body three and a half inches long. There is a preserved specimen in the Spring Hill College Museum. In the South,

and in fact everywhere, the only spider that is dangerous is the famed Black Widow. The large poison glands contain venom more potent than that of a rattlesnake. We will speak of this species later on.

There are about eight families of spiders common in the U. S. A. but among these there are very many subdivisions into sub-families and genera. These families are:

a. The Wolf-spiders or *Lycosidae*
b. The Combfoot-spiders or *Theridiidae*
c. The Crab-spiders or *Thomiisidae*
d. The Jumping-spiders or *Attidae*
e. The Orb-web-spiders or *Argiopidae*
f. The Tarantulas or *Aviculariidae*
g. The Pholcids or *Pholcidae*
h. The Grass-spiders or *Drassidae*

All these families are well represented at Spring Hill with the possible exception of the Tarantulas, which so far we have not been able to find. As far as the families are concerned, spiders are not really hard to classify for the general characters are well marked and consist mostly in habitat or those more external features easily recognizable to the naked eye and with not too much examination. For example, everyone has seen those little black and grey spiders running over the fields. They are the wolf spiders probably out on a hunt. Shake any of our hydrangia bushes or azalea bushes and invariably a crab spider will fall out. No matter how well Springhillians clean their homes, at some time or other they are going to find that a Pholcid has made its home in some out of the way corner. Likewise no amount of dusting will ever eliminate the common house spider, the Theridiidae from in the inside of homes!

A sure visitor on the window-sill will be the alert little jumping spider, one of the Attidae, looking for mosquitoes or flies. The Drassids are a little harder to find, but turn over the pine needles or dry leaves on any meadow or in some damp spot in the woods, and a pretty little reddish spider will be seen running out. Anyone who has walked down the stream behind the College lake has seen the low webs of the Tetragnathids or run into the yellow, bright web of Nephila or Miranda. These are representatives of the Argiopidae. As far as the families are concerned they are all here and easy to find.

The Genera present another story! The shape of the abdomen although not useful for a specific classification will help shift some of the difficulty of classifying. Spiders that do not spin elaborate webs and live their lives wandering and searching for food generally have a stockier appearance, shorter and stronger looking legs and smaller abdomen than those that spin large webs. Their coloring is not as bright

and they move with great rapidity on the ground. The web-weavers are awkward and almost helpless on the ground, usually have brighter colors, like yellow or bright brown and tan, even green and red. Their legs are long and slender. That merely is giving a general distinction between the two main groups. The uninitiated will not find it easy to distinguish between the types of webs, so this does not seem to me to be a handy method of classification in the beginning.

Once the specimen is secured the following have to be considered: the number of book lungs; the number of tracheal spiracles and where located; the size and appearance to the naked eyes of the spinnerets. All this can be done by observing the ventral abdominal region. Already a hand-glass is necessary, for these parts are not easy to see with the naked eyes.

Looking at the spider from the anter cephalothoracic end, the number of eyes has to be ascertained. Are there eight, six or four? Are they arranged in two, three or four rows? Are they procurved or recurved, that is, do they curve towards the front or towards the back? All these little characteristics help to sift the families into genera, and in some cases will already give the species. Here are some concrete examples:

The Argiopoidea, or true spiders, have one pair of book lungs and a single tracheal spiracle located in the median line ventrally and towards the spinnerets. However, there are exceptions—Hypocholidae
Filistatidae
Conopidae
Dysderidae
Caponidae

Of these, Hypocholidae, has two pairs of book-lungs and no spiracles; Filistatidae, Conopidae, Dysderidae have one pair of book-lungs and one pair of spiracles; the Caponidae have no book lungs and two pairs of spiral trachea. The book lungs look like tiny bags while the tracheal spiracles are merely two or one small opening. Besides this, the first two families just mentioned (Hypocholidae and Filistatidae) are eight eyed spiders while the second two (Conopidae and Dysderidae) are six-eyed spiders.

More characteristics that have to be considered are the condyle, scopula and teeth of the Chelicerae; the number of claws of the Tarsi; and finally whether or not a Calamistrum is present.

Mathematics

A THEOREM ON PROPORTIONS

By Robert O. Brennan, S.J.

Some college algebra texts in their treatment of ratio and proportion include a number of theorems on "proportion by composition and division", *i.e.*:

if $a/b = c/d$

then, by composition: $\dfrac{a+b}{b} = \dfrac{c+d}{d}$

by division:

$$\frac{a-b}{b} = \frac{c-d}{d}$$

by composition and division:

$$\frac{a+b}{a-b} = \frac{c+d}{c-d}.$$

The first two proportions are proved by adding $+1$ and -1 respectively to both sides of the equation $a/b = c/d$. The third proportion is the quotient of the first two, member by member.

Occasionally a more complex combination is given:

If $a_1/b_1 = a_2/b_2 = \ldots = a_n/b_n$,

$$\text{then } a_1/b_1 = \frac{a_1 + a_2 + \ldots + a_n}{b_1 + b_2 + \ldots + b_n}$$

Even this, however, is of little avail if one runs across in his reading an expression of the form[1]:

$$a_1/b_1 = a_2/b_2 = \ldots = a_n/b_n = \frac{\sqrt{(a_1^2 + a_2^2 + \ldots + a_n^2)}}{\sqrt{(b_1^2 + b_2^2 + \ldots + b_n^2)}}$$

This particular form can be demonstrated geometrically for the case $n = 2$ by constructing two similar right triangles with sides a_1, a_2, $\sqrt{(a_1^2 + a_2^2)}$ and b_1, b_2, $\sqrt{(b_1^2 + b_2^2)}$ respectively.

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[1] *Cf.*, for instance, Harold Jeffreys and Bertha Swirles Jeffreys, *Methods of Mathematical Physics*, Cambridge, at the University Press, 1946, p. 62.

The theorem once proved for $n=2$ can be generalized by mathematical induction. The following extension of the theorem to the case $n=3$ will suggest the method.

Let $a_1/b_1 = a_2/b_2 = a_3/b_3$.

Application of the theorem, valid for $n=2$, gives

$$a_1/b_1 = \frac{\sqrt{(a_1^2+b_1^2)}}{\sqrt{(b_1^2+b_2^2)}} = a_3/b_3$$

A second application of the same theorem to the second two members of this equation yields:

$$a_1/b_1 = \frac{\sqrt{(a_1^2+a_2^2+a_3^2)}}{\sqrt{(b_1^2+b_2^2+b_3^2)}}$$

An algebraic proof of the theorem is more elegant and capable of much easier and broader generalization.

We shall require the definition of a homogeneous function: A homogeneous function is one whose terms are all of the same degree.

It follows that is each variable of a homogeneous function of degree r is multiplied by the same constant, say k, the whole function is multiplied by k^r. *i.e.*: if $\varphi(x_1,x_2,\ldots,x_n)$ is a homogeneous expression of the rth degree (r may be fractional or irrational), then $\varphi(kx_1,kx_2,\ldots,kx_n) = k^r\varphi(x_1,x_2,\ldots,x_n)$.

There will be no difficulty now in proving the following theorem adapted from Chrystal[2]:

If $\varphi(x_1,x_2,\ldots,x_n)$ be any homogeneous function of the variables $x_1,x_2\ldots,x_n$ of the rth degree, and if

$$a_1/b_1 = a_2/b_2 = \ldots = a_n/b_n,$$

then each of these ratios is equal to

$$\frac{\varphi(a_1,a_2,\ldots,a_n)^{1/r}}{\varphi(b_1,b_2,\ldots,b_n)^{1/r}}$$

Let $a_1/b_1 = a_2/b_2 = \ldots = a_n/b_n = k$.

Then, $a_1 = kb_1$
$a_2 = kb_2$
$\ldots\ldots\ldots$
$a_n = kb_n$

Substitution of these values into

$$\frac{\varphi(a_1,a_2,\ldots,a_n)^{1/r}}{\varphi(b_1,b_2,\ldots,b_n)^{1/r}} \text{ gives } \frac{\left[k^r\varphi(b_1,b_2,\ldots,b_n)\right]^{1/r}}{\left[\varphi(b_1,b_2,\ldots,b_n)\right]^{1/r}} = k,$$

in virtue of the property of homogeneous functions stated above. Since each of the ratios $a_i/b_i = k$, the theorem is proved. This theorem includes as special cases the several theorems stated above.

[2] G. Chrystal, *Algebra*, London, Adam and Charles Black, Fifth edition 1914 Part 1, p. 263.

Book Review

HUMAN DESTINY

du Nouy, P. Lecomte

Longmans, Green. February, 1947. 289pp. $3.50

There is so much good in this book that it is a dangerous book. We Catholics are so often greatly pleased at finding scientists and others propounding Catholic truths, that we tend to overlook the errors, and gross errors, that are included within the same covers as the truths. I am afraid that this situation is at present obtaining in the case of "Human Destiny".

The purpose of this review is to indicate the parts of du Nouy's book which should be of interest and use to Our scientists; and to point out the deviations from Catholic doctrine which render the book harmful, and which contraindicate its recommendation to Our students or other Catholics.

The best thing in the book, and the most useful for Ours, is the discussion of Chance in Chapter 3. Here great simplicity and lucidity is applied to the explanation of the mathematics of Chance and to showing the impossibility of mere Chance satisfactorily explaining, for instance, the origin of a mere molecule, much less Life itself. This is a profitable chapter.

The author's ideas on Evolution (before he discusses the moral evolution of Man) are many and good, and all of them stimulating. The constrast between the inorganic and the vital (pp. 41-2, and foll.); the distinction between mechanisms such as adaptation or natural selection and the great tide of finalism (Chapter 7, and pp. 202-205); the marked discontinuity evidenced in the apparition of Man on the terrestrial scene (pp. 99, 114, 167; especially the last where he has some good words on the difference between intelligence and animal instinct) . . . these are fruitful discussions for those of us interested in the problem of Evolution. The emphasis on finalism is refreshing since all of us have had to read such materialistic and "rational" tripe in our time.

Is it too carping to object to the word "telefinalism" for the author's theory (summary on pp. 223-7) on etymological grounds? Other more serious objection to it will be registered later.

Some other shorter discussions are also good. The distinction between the imagined picture of God and the concept of God (pp. 188 foll., especially p. 193) is fairly consoling. There is a nice paragraph

on what Arnold Lunn (if I remember correctly) called a "blank check on the future", i.e., the argument that science will in the future solve all difficulties (p. 194).

The emphasis, throughout the book, on the moral plane, on human dignity, on human liberty (e.g., pp. 109 foll.), on the need for moral education (Chapter 15) and particularly on the need of the inculcation of justice (p. 271) and the need of religion (p. 186), is all to the good. But this emphasis will cause no great surprise to Catholics, who have been stressing these principles for a long time now. They will be as little startled by these principles as by the expression of such well-known theses as the author's discovery that true science and true religion cannot be in conflict (pp. 185, 243).

In general, the sincerity behind many expressions of reverence for the Christian heritage and for Christian principles is indubitable (e.g., pp. 258, 267). The whole tone of the book is lofty, and obviously proceeds from a noble soul. All this, in its way, helps to make the book dangerous.

I now intend to point out the anthropological, philosophical and theological errors which are found in the book.

There are incidental anthropological mistakes, not too important in comparison with others. Such are: the statement that the ancestors of Cro-Magnon man made arrowheads (p. 124), that the Cro-Magnon race was excessively tall, which it was not (p. 125), that the burials in the famous Grotte des Enfants at Menton were of Neanderthal age (p. 104).

But we must balk at the undeveloped nature of the "primitives" as depicted by du Nouy (passim). Speculation on the "primitives" of time, real first men, is speculation and nothing more. And it is speculation of the rankest kind, straight from the pages of the nineteenth century evolutionists. These people, taking their own ideas and culture as the top of the scale, postulated the exact opposite (e.g., utter promiscuity versus monogamy) as zero on the scale; then they proceeded to act as if this postulate were a fact.

As far as we can learn about primitives from present-day aliterate peoples of the most simple cultures, the work of Fr. Schmidt and others has long since disposed of the idea (propounded especially by the Durkheim-Levy-Bruhl school) that "primitives" were equipped with pre-logical minds and with superstition and magic in place of religion. In point of fact, the "primitives" of today, the aliterates lowest on any technological scale possess remarkably high religious ideas.

The statements that superstition is the first step towards religion (165), or that paganism and fetishism are the first step (p. 168), are unadulterated and unsupported speculation. I suppose, forsooth, that it was during this first "step" that hell was "invented" (p. 237)!

It comes as something of a shock to learn that the esthetic sense, whose products have been preserved for us in the magnificently

decorated cave art of the Upper Palaeolithic, is the primitive source of intelligence (p. 127). The manufacture of purposive and often complicated tools long before that, as well as, for instance, burial and presumably religious practices among the Neanderthalians (e.g., at Drachenloch), would certainly be well judged to indicate that we do not have to wait for the highly developed art of the Magdalenian period for the beginning of intelligence!

That the belief in an after-life and in personal immortality sprang into being purely as the result of projection (pp. 105-6) is incredible to us. It is a mental tour de force not worthy of the effort to encompass the idea that the initial use of fire (an event unknown except to speculation) brought man a step nearer the appreciation of a Creator, because it occasioned the creation of an imaginary deity (p. 167).

Naivete in matters philosophical is manifested also in the first pages of the book, in which an inadequate discussion of the concept of cause and of epistemology and of the true nature of physical certitude is given (Chapters 1 & 2). That the superior intelligence, liberty and morality of Man, which is treated with such reverence throughout the book, is simply the working of the material brain on a level which is closed off from our present natural-scientific investigation (p. 231) (although the author is trenchantly against materialism in Chapter 4), is a position which outdoes that harmless Wonderland in which Alice once found that logic was beside the point.

In fact, the author gradually reveals that he is an emergent evolutionist at heart. If Emergent Evolution ever explained anything, philosophically, this reviewer would appreciate being informed!

Theologically, the fundamental fault (brushing aside many that could be noted) is an utter humanitarianism; in addition there is a confusion of the supernatural with the natural spheres.

Let me remark on the second fault first. Original sin is not simply the remains of the animal in us, against which we must fight and which we must conquer if the moral evolution of Man is to proceed (pp. 116; 195-6), although of course the war of the flesh and the spirit is familiar to us all. But original sin is the privation of a supernatural good and gift of God. Christ is not simply the most perfect Man that ever lived, a specimen of that truly perfect and spiritual Man toward which the human race is evolving (pp. 117, 174, 177, 197). As an aside, let me remark that I know of no evidence that the "race" is evolving *in toto* towards a superior race at all (p. 141).

The simple fact of the matter is that writing efficaciously about the spiritual life of Man is not possible, if one omits Revelation and the supernatural; nor will any amount of vague deference to the Christian ideal or Christian civilization or Christ the perfect Man satisfy.

The mere teaching of a universal history, superior moral training, the realization of the dignity of Man and men, all these, although good in themselves, are not enough—not since the coming of Christ the God-Man into the world.

Specifically, also, I ought to mention the approval of all religions as equally good, all striving toward the same end although by different routes (p. 180); even if the superior merits of Christianity are fairly often mentioned (e.g., pp. 258, 267). We must recognize the existence in the world of many sincere and ignorant souls, and we know that God takes care of them; but that does not place their religious beliefs on an objective and ontological par with the true revealed religion. We can hardly subscribe to the statement that the religious spirit is of divine origin (true enough) but that religions in the concrete are all of human origin (p. 179).

The stigmatization of the Church (sometimes with the adjective of "Catholic" attached) as the adopter and adapter of many false pagan practices and superstitions which obscure the true religious teaching of Christ (pp. 172-5); and the plea for the "Church" to put off sundry accretions of a superstitious nature (pp. 228, 238), have a familiar ring. But we await the author's coming down to cases. Just what official practices of the Catholic Church can be proven to be of such nature?

Hand in hand, as so often happens with the confusion of the supernatural and the natural spheres goes an utter humanitarianism. However, we know that Man (p.244), or a superior race of the same (p. 235), is *not* the goal of Man. Just as an immortality which consists solely in the good effects we can leave behind us in the world is not immortality at all (pp. 253-4; nor is personal immortality beyond the powers of reason, p. 254), so a beautifully conceived moral evolution which does not have God as its goal is a fiction, and a fiction of the most detestable consequences. God is the goal of Man.

I realize, from my own experience, that I get so used to certain errors in certain types of books that I sometimes let slip an unqualified recommendation of a book, forgetting that the person I am talking with would not automatically take the errors in his stride and reject them. I hope that the lengthly mention of errors in this book will assist in making sure that such a thing does not happen in the case of this book. We can use the discussions that are fruitful, for our own scientifico-philosophical work; but there is no reason at all for recommending this book to less well-trained Catholics.

J. Franklin Ewing, S.J.

For those interested in instrumentation, two significant pamphlets appeared in 1946. Polarized Light Microscopy by Philip J. West has been reprinted in pamphlet form from three articles that had appeared in the J. T. Baker Chemical Company's Chemist Analyst. It is well illustrated and it features seventeen laboratory exercises for student use. It may be had gratis. A second pamphlet on instrumentation is supplied gratis by the G. Frederick Smith Chemical Co., 887 McKinley Ave., Columbus, Ohio. It is Colorimetry for Chemists by M. G. Mellon. It is the twelfth in a series of analytic pamphlets published by this company. It features a series of experiments in spectrophotometry.

The Journal of Colloid Science came into being this past year under the editorship of Victor K. LaMer of Columbia University. It is published six times per year by the Academic Press, Inc., N. Y., at an annual subscription rate of ten dollars. The Journal of Polymer Science also appeared this year. Its first issue appears as the Journal of Polymer RESEARCH. With succeeding issues, the name was changed, due to the fact that at the last minute it was decided to combine a projected new journal, High Polymers, with the Journal of Polymer Research. It appears bimonthly, at $8.50 per annum, from Interscience Publishers, Inc., 215 Fourth Ave., New York 3, N. Y.

The British Chemical Society promises a new journal, Quarterly Reviews, the first number of which is expected to appear toward the end of February, 1947 at an annual subscription of 10 s. 6 d. to members. Each issue will contain approximately 96 pages.

It may be reasonable to start new journals in a given library from the very first issue, especially since there is no hope of continuing the German journals for some years to come. It is to be noted too that a critically selected pamphlet collection is of great value. Indeed, before World War II, the library of our theologate in Maastricht, Netherlands, had an international reputation for its pamphlet collection on Jansenism.

Rev. Bernard A. Fiekers, S.J.

College of the Holy Cross, Worcester 3, Mass. December 17, 1946.

News Items

HYDROPONICS

In December of last year, the District Superintendent of Parks of the City of Buffalo, Mr. Louis H. Neubeck, offered the greenhouse facilities of one of the local Botanical Gardens to the Biology Department of Canisius College. At the time of the offer we did not think it possible to make use of such an excellent opportunity because all the Biology Courses were well underway and in planning the laboratory work no special work in Botany had been envisioned. After the beginning of the second semester it was decided to try some experiments in Hydroponics with the General Physiology students. The excellent facilities at our disposal and the many advantages the students would derive from an experiment which could serve as an introduction to research could not be overlooked.

It was decided to have the students run a series of experiments over a period of 8 weeks with various complete and deficient solutions and have them determine their effects on the external development of various plants. Gravel cultures were used; corn, green peas and cucumbers were selected as the plants to be studied. Each student was given two metal boxes coated with agricultural tar and filled with sterilized gravel. Two of the above plants were assigned him for his work and beside the "soiless" boxes he was given a small plot of earth where controls could be cultivated.

The laboratory periods were all carried out at the greenhouse and the entire experiment was carried out with great enthusiasm and interest which expressed itself practically in the care and interest with which the students worked on their projects.

Fresh solutions were made every two weeks, pH was determined regularly, roots, stems and leaves were carefully observed and measured at each laboratory period. Several students used cameras to help their records. The entire project received enough publicity in the local newspapers to insure several curious spectators at each laboratory who lost no time in questioning the workers about the various results.

In the meantime we were able to obtain some information from several experimental greenhouses and other Colleges where similar work had or was being done. The reprints were included as part of the required reading matter. At the conclusion of the 8 weeks detailed reports were written. These reports were written in true scientific form, the reprints being used as models. The observations and the

making of records was good training in evaluating results which were compared with those of other workers in this field. The students were introduced to the difficulties of such work and they had the opportunity to become acquainted with a science which if not new, is at least making great progress contemporaneously. The interest of the students, the good results obtained and the final reports all indicated that the entire experiment was a genuine success.

CANISIUS COLLEGE CHEMISTRY DEPARTMENT

The following talks were delivered by the Chemical Affiliates of Canisius College at their meetings during the past year.

HISTORY OF CHEMISTRY

Robert D. Roach, Jr., '49, "Scientific Work of Dr. George Washington Carver."
John R. Conroy, '47, "Thomas A. Edison—His Influence on the Modern Research Laboratory."
Edward A. Napier, '48, "Tomorrow's Future in Chemistry."
Donald E. Schuler, '50, "History of the Nobel Prize."
Edward N. Weber, '48, "Licensing of Chemists."

INORGANIC CHEMISTRY

F. Robert Smith, '49, "Carbon Dioxide."
Andrew J. Szlachtun, '50, "Chlorine."
James V. Martin, '47, "The Inert Gases."
John L. Hosterman, '50, "The Electron—Its Discovery."
Theodore Labuzzetta, '47, "Sodium Hypochlorite—Its Commercial Preparation."
Stanley E. Gebura, '49, "Chemicals from the Sea; Extraction of Bromine."
Charles E. Barson, '50, "Glass."
Howard J. Curtin, '47, "Glass in Modern Civilization."
Perry R. Monroe, Jr., '49, "Colloids—Liquids or Solids—1."
Anthony J. Rosica, '50, "Colloids—Liquids or Solids—2."
Thomas F. Klein, '49, "Emulsions Prove Oil and Water DO Mix."
Woodrow J. Huff, '49, "What are Emulsions?"

ORGANIC CHEMISTRY

John N. Viverito, '48, "Synthetic Phenol."
Richard A. Balbierz, '48, "Phenol-Formaldehyde Plastics."
Lawrence D. Caul, '49, "Textile Dyes."
John J. Maddigan, '47, "Fluorocarbons."

ANALYTICAL CHEMISTRY

Jerome C. Schley, '49, "Indicators and Titration Curves."
Girard E. Georger, '49, "Volumetric Methods of Chloride Determination."
William C. Cullen, '48, "The Chemical Analysis of Food Products."
Arthur D. Zielinski, '49, "Analysis of Fluorine."
Edward J. Kinsley, '49, "Co-precipitation in Sulfur Determinations."
Robert A. Zubler, '49, "Methods for Reducing Iron."
Robert P. Hueber, '49, "Oxidation—Reduction Indicators."
Louis M. Osika, '47, "Methods of Separation and Tests for Purity."

PHYSICAL CHEMISTRY

Eugene L. Beltrami, '47, "Dumas Method of Molecular Weight Determination."
Louis J. Rescigno, '47, "Victor Meyer Method of Molecular Weight Determination."
James M. Naughton, '47, "Relationship of Volumes of Gases to Their Temperature and Pressure."
Richard I. Kruzicki, '48, "Photochemistry—Influence of Temperature."
James L. Graham, '47, "Compass Planimeter."

CHEMISTRY IN MEDICINE

Earl E. Brady, '48, "The Sulfa Drugs."
Robert L. Lounsbury, '48, "Vitamin B_1."
Herbert G. Beierl, '48, "Derivatives of Barbituric Acid in Medicine."
Daniel F. Krawczyk, '49, "Chemistry in Cancer."
Joseph R. Ruh, '48, "Sulfathioazole."
Edwin A. Wojtan, '48, "Penicillan."
Francis P. Rozek, '48, "Riboflavin."

HOLY CROSS CHEMISTRY DEPARTMENT

An electrical heater for funnels was developed in this laboratory by Father Fiekers and Arthur Martin, the college electrician. Its construction and the technique for using it appear in (J. T. Baker Co.) Chemist Analyst, 35, 93-94 (1947). A report of work done at the University of Wyoming by Andrew VanHook, Professor of Physical Chemistry here, appears under the title: "Kinetics of Sucrose Crystallization: Mechanism of the Reaction of Real Massecuites," in Proc. (4th Gen. Meeting, 1946) Am. Sco. Sug. Beet Technicians, pp. 558-564.

Departmental registration for the term starting Feb. 1947 tallies 376 students, of whom 180 are taking courses in Freshman Chemistry.

At the recent annual meeting of the Worcester Chemists' Club, Dr. Vanhook was elected Secretary-Treasurer for next year and Father Fiekers was elected to the Executive Board. A local section of the American Chemical Society for Worcester County (Mass.) was approved by the A.C.S. in the Atlantic City Meeting, this Spring. Its organization is expected to occur in September or October 1947. Father Fiekers represented the College at the annual meeting of the New England Conference on Graduate Study, held at Smith College May 2nd and 3rd, 1947.

On May 10, 1947 the College was host to the New England Association of Chemistry Teachers. Three technical papers were presented: Dr. VanHook of the staff spoke on Advances in Sugar Technology and the work of the Sugar Research Foundation; Prof. T. L. Kelly, formerly of this department, spoke on the Chemical Senses, Gustation and Olfaction; Dr. Hudson Hoagland of the Worcester Foundation for Experimental Biology, spoke on the Steroid Hormones in their Relation to Behavior. Luncheon was held in the Student Dining Room in Kimball Hall.

THE HOLY CROSS VOCATIONAL SERIES

The Tomahawk, weekly publication by students of Holy Cross College, has carried, through the academic year 1946-1947, a series of vocational articles by alumni who are prominent in their several fields of endeavor. This innovation, which is under the direction of the Rev. Richard J. Dowling, S.J., is of inestimable value to students and to their advisors. It has already attracted unexpected attention from quarters that are not ordinarily interested in the work of the college. If the demand warrants it, this series will be continued indefinitely and may eventually appear in book form. Indeed, one item on Surgery by Dr. John M. Fallon, is about to appear in pamphlet form; and a second item is being similarly considered. A select list of articles that bear on chemistry, either already published or to appear shortly, is given below, because of its interest to professors of chemistry who are also engaged in advisory work.

Dr. John M. Fallon, on the Profession of Surgery.

Dr. Lloyd F. Smith, on the Profession of Medicine.

Dr. George W. Whitby, on the Profession of Dentistry.

Prof. T. Leonard Kelly, on the Teaching of Chemistry.

Richard B. Bishop, on Chemical Research as a Career.

Joseph F. Boyce, on Metallurgy as a Career.

William J. Shea, Jr., on Pharmacy as a Career.

Raymond J. Barth, on Chiropody as a Career.

William F. McNiff, on the Teaching of Physics.

Matthew J. Couming, on the Teaching of Mathematics, and

Dr. J. Francis Hartmann, on the Teaching of Biology.

The series also includes contributions on the Priesthood, Business, Law, Insurance, F.B.I. work, and so forth.

LOYOLA COLLEGE CHEMISTRY DEPARTMENT

The Chemistry Department at Loyola is growing rapidly. There are now five men in the Department, Headed by Father Hauber. In addition, we have Dr. H. C. Freimuth from N.Y.U., who is also toxicologist for the State of Maryland. We have two men from Johns Hopkins, one Dr. Ellis R. Lippincott, who just received his Ph. D. and the other, Herman C. Wagner, soon to obtain his doctorate, Mr. Joseph A. Sellinger, S.J., completes the department.

We have added a new course in Electrochemistry for the spring semester. For next fall we are planning to introduce a course in Biochemistry and a course in Library Research. In addition for the first time since before the war, we will offer a course in Qualitative Organic.

By next September, we should have a representative number of graduates of Loyola doing graduate work in Chemistry at the various Universities on the eastern seaboard.

On April 19, Loyola was the host at the spring meeting of The Catholic Round Table of Science, Washington-Maryland Chapter. At this meeting, held immediately after the luncheon, Father Bier, S.J., spoke on *Factors and Faculties in Modern Psychology.*

VOLUME XXIV 1946-1947

AUTHOR INDEX

JESUIT IN SCIENCE BULLETIN

INDEX TO VOLUME XXIV — 1946-1947

SUBJECT INDEX